FRISCHKNECHT, R. (1998a): Life Cycle Inventory Analysis for Decision-Making; Scope-dependent Inventory System Models and Context-specific Joint Product Allocation, ETH Ph.D.-thesis Nr. 12599, Uster

FRISCHKNECHT, R. (1998b): Allokation in der Sachbilanz bei starrer Kuppelproduktion, in R. Frischknecht, S. Hellweg (Eds.), Ökobilanz-Allokationsmethoden. Modelle aus der Kosten- und Produktionstheorie sowie praktische Probleme in der Abfallwirtschaft. Vorbereitende Unterlagen des 7. Diskussionsforums Ökobilanzen vom 24. Juni 1998 an der ETH Zürich. Laboratorium für Technische Chemie, Gruppe Sicherheit und Umweltschutz, ETH Zürich. pp. 38-49

GOEDKOOP, M. (1995): The Eco-indicator 95; Final Report, PRé Consultants B.V., Amersfoort

GOEDKOOP, M.; SPRIENSMA, R. (1999): The Eco-indicator 99; A damage-oriented method for Life Cycle Impact Assessment, Methodology Report, PRé Consultants B.V., Amersfoort

HORNGREN, C.T.; FOSTER, G. (1991): Cost Accounting, A Managerial Emphasis, 7th edition, Prentice Hall International Inc.

KREWITT, W.; HECK, T.; BOYD, R.; EYRE, N. (1997): Aggregation - External Costs from Electricity Generation in Germany and the UK, Final Report, Stuttgart

LINDFORS, L.-G.; CHRISTIANSEN, K.; HOFFMAN, L.; VIRTANEN, Y.; JUNTILLA, V.; HANSSEN, O.-J.; RØNNING, A.; EKVALL, T.; FINNVEDEN, G. (1995): ALLOCATION; TECHNICAL REPORT No 7. IN LINDFORS, L.-G.; CHRISTIANSEN, K.; HOFFMAN, L.; VIRTANEN, Y.; JUNTILLA, V.; LESKINEN, A.; HANSSEN, O.-J.; RØNNING, A.; EKVALL, T.; FINNVEDEN,

G.: LCA-Nordic; Technical Reports No 1-9. Nordic Council of Ministers, TemaNord 1995:502, Copenhagen

MILL, J.S. (1848): Principles of Political Economy; With Some of Their Applications to Social Philosophy, Vol. II, John W. Parker, West Strand, London

MÜLLER-FURSTENBERG, G. (1998): Kostenallokation bei starrer Kuppelproduktion, in R. Frischknecht, S. Hellweg (Hrsg.) Ökobilanz-Allokationsmethoden; Modelle aus der Kosten und Produktionstheorie sowie praktische Probleme in der Abfallwirtschaft, vorbereitende Unterlagen zum 7. Diskussionsforum Ökobilanzen vom 24. Juni 1998, ETH Zürich

SCHNEIDER, F. (1996): Analyse des Réemplois, Récyclages, Valorisations de Déchets par l'Etude de Systèmes Cascade, Thèse 96ISAL0132, Institut National des Sciences Appliquées de Lyon

SHAPLEY, L.S. (1953): A value for n-persons games, in A.W. Kuhn, A.W. Tucker (ed.) Contributions to the Theory of Games, Vol. II, Princeton University Press, p. 307-317

UDO DE HAES, H.A.; DE SNOO, G.R. (1996): Environmental Certification; Companies and Products: Two Vehicles for a Life Cycle Approach, Int. J. LCA 1 (3), p. 168-170

VAN ENGELENBURG, B.C.W.; NIEUWLAAR, E. (1994): A framework for a just allocation procedure, in G. Huppes, F. Schneider (ed.), Proceedings of the European Workshop on Allocation in LCA, Feb. 24-25, Leiden 1994, p. 102-119

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Modelling the Valuesphere and the Ecosphere:

Integrating the Decision Makers' Perspectives into LCA

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Abstract. Methods for Life Cycle Impact Assessment have to cope with two critical aspects, the uncertainty in values and the (unknown) system behaviour. LCA methodology should cope explicitly with these subjective elements. A structured aggregation procedure is proposed that differentiates between the technosphere and the ecosphere and embeds them in the valuesphere. LCA thus becomes a decision support system that models and combines these three spheres. We introduce three structurally identical types of LCA, each based on one coherent but different set of values. These sets of values can be derived from the Cultural Theory and are labeled as 'egalitarian', 'individualistic', and 'hierarchic'.

Within Life Cycle Impact Assessment, a damage oriented assessment model is complemented with both a newly developed precautionary indicator designed to address unknown damage and an indicator for the manageability of environmental damages. The indicators for unknown damage and for manageability complete the set of indicators judged to be relevant by decision makers. The weights given to these indicators are also value-dependent. The framework proposed here answers the criticisms that present LCA methodology does not strictly enough separate subjective from objective elements and that it fails to accurately model environmental impacts.